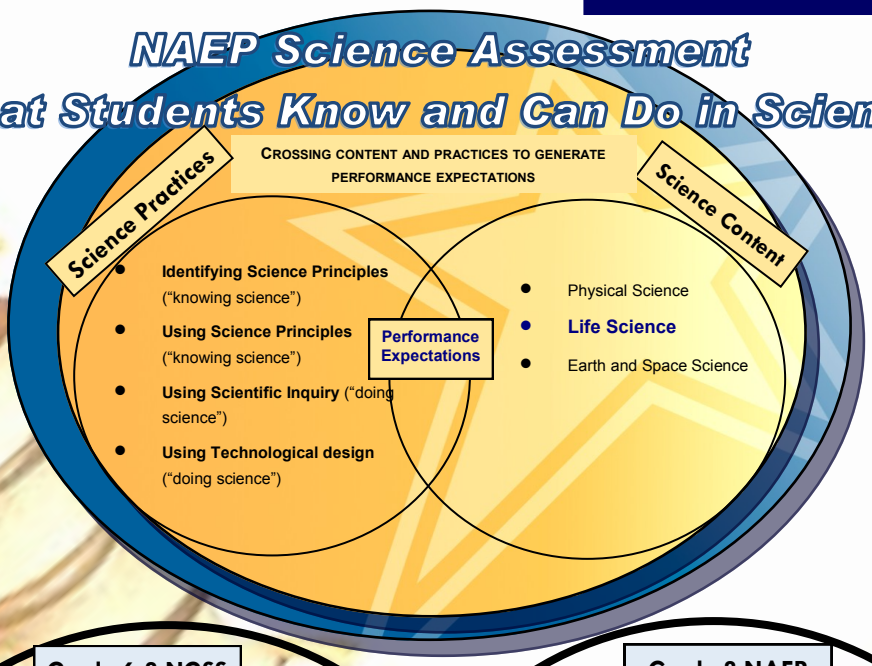
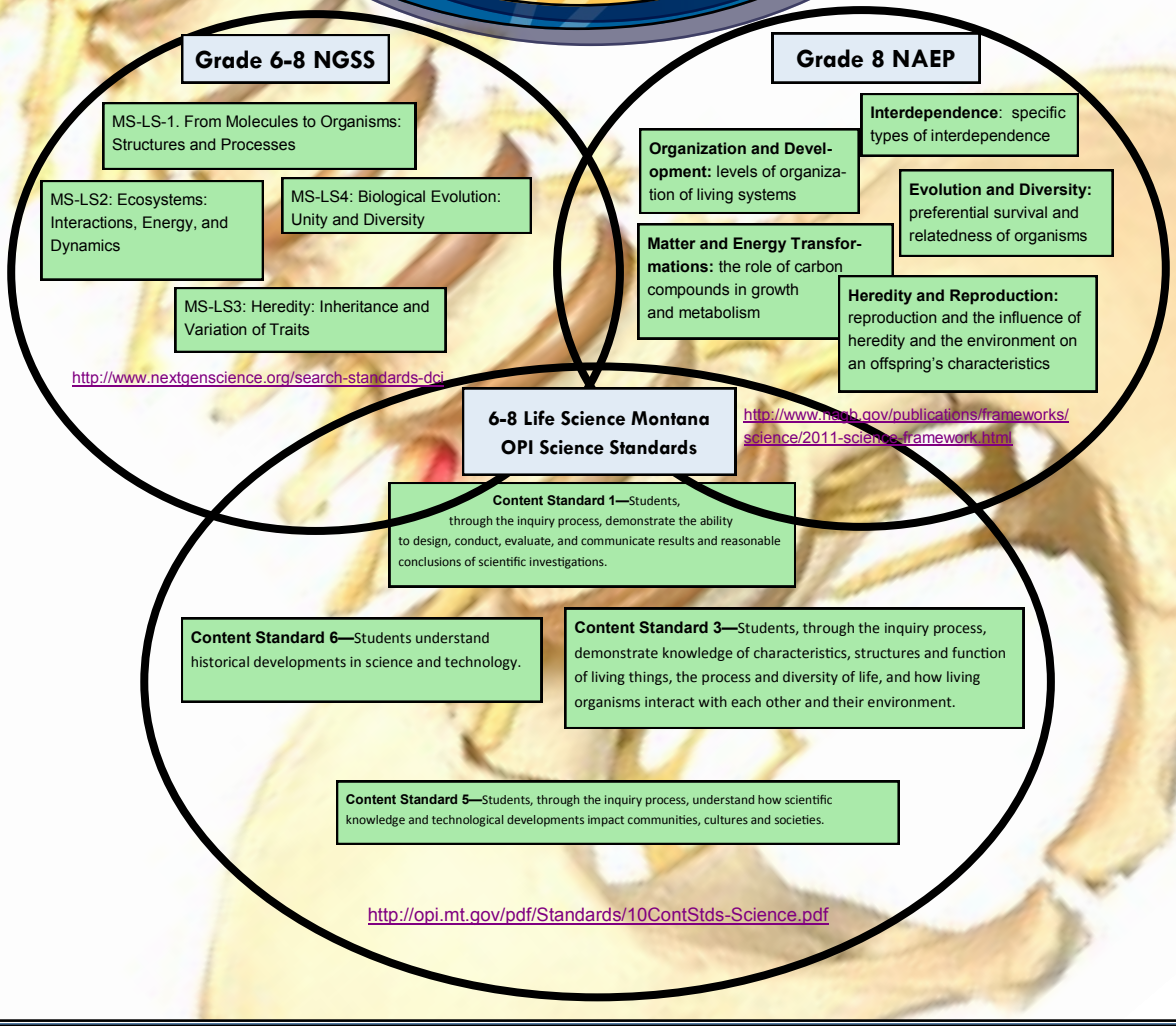
6-8 LIFE SCIENCE

October 2013 Volume 1, Issue 1

Inside this issue:

NAEP Science Assessment
What Students Know and Can Do in Science





This brochure is the creation of Ashley McGrath Montana's NAEP State Coordinator, users should be diligent in checking standards and frameworks for accuracy and appropriateness. For questions, please contact amgrath@mt.gov.

NAEP'S science practices are associated with these cognitive demands :

(1) "knowing that,"

(2) "knowing how,"

(3) "knowing why" and

(4) "knowing when and where to apply knowledge."

The practices are (1) Identifying Science Principles, (2) Using Scientific Inquiry, (3) Using Scientific Principles, and (4) Using Technological Design.

Source:
www.nagb.gov (click here)

Points of Interest:

- The average nation percent correct for all hands-on tasks in 8th grade 2009 was **44%**.
- The average nation percent correct score for all interactive computer tasks in 8th grade 2009 was **41%**.
- **84%** of 8th grade students could use a simulated laboratory to test how much water flowed through two different soil samples.
- **24%** of 8th grade students could appropriately decide how to manipulate four metal bars made of unknown materials to determine which ones were the magnets.

Source:
http://nationsreportcard.gov/science_2009/

Dimension 2: Crosscutting Concepts in NGSS

CROSSCUTTING CONCEPTS THAT HAVE COMMON APPLICATION ACROSS FIELDS

"*Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas.*"
— A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. p. 233

1. **Patterns**– Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

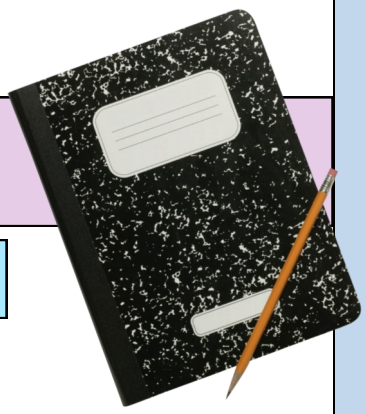
- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.
- Patterns can be used to identify cause and effect relationships.
- Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems.
- Graphs, charts, and images can be used to identify patterns in data.

2. **Cause and effect:** Mechanism and explanation– Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.
- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.
- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

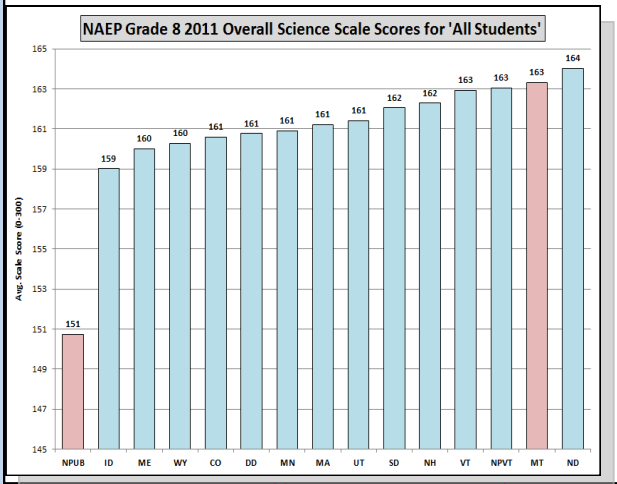
3. **Scale, proportion, and quantity**– In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
- Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.
- Phenomena that can be observed at one scale may not be observable at another scale.



4. **Systems and system models**– A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.
- Models can be used to represent systems and their interactions.
- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.



NOTE: All numbers are rounded and observed differences may not be statistically significant. Only 15 jurisdictions are depicted with the top ten jurisdictions shown on the right. SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2011 Science Assessment.

Explore NAEP data in the NDE

*Footnote: All *Crosscutting Concept* information was obtained from: http://www.nextgenscience.org/search-performance-expectations. More examples of crosscutting concepts can be found in the NGSS Appendix G-Crosscutting Concepts.

Dimension 2: Crosscutting Concepts in NGSS

Users should be diligent in checking standards and frameworks for accuracy and appropriateness.

DIMENSION 2: CROSSCUTTING CONCEPTS THAT HAVE COMMON APPLICATION ACROSS FIELDS

5. **Energy and matter:** Flows, cycles, and conservation– Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.

- Matter is conserved because atoms are conserved in physical and chemical processes.
- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.
- Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).
- The transfer of energy can be tracked as energy flows through a designed or natural system.

6. **Structure and Function** – The way an object is shaped or structured determines many of its properties and functions.

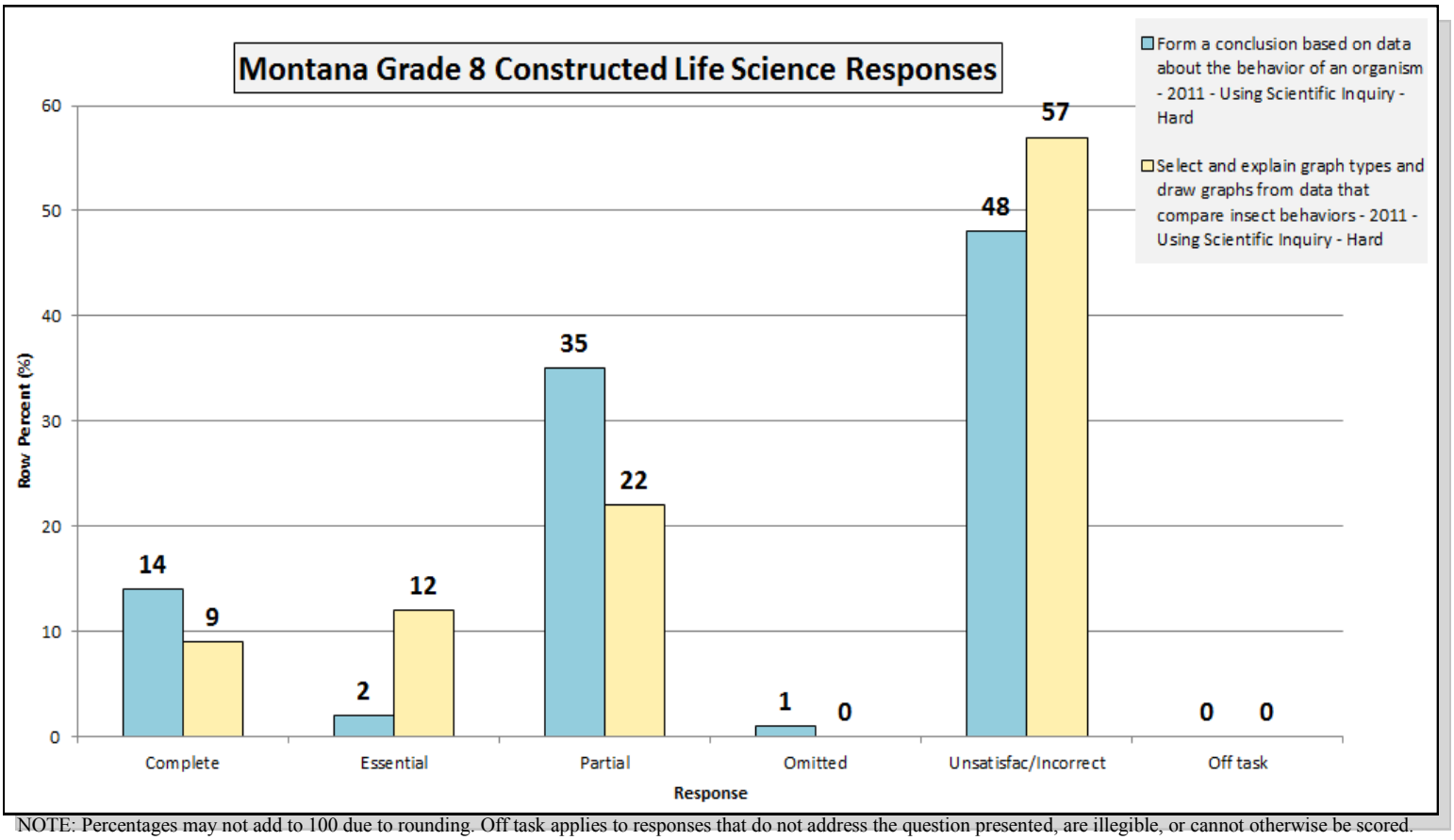
- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.
- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.
- Structures can be designed to serve particular functions.

Montana grade 8 students were likely to give a "complete" answer on the "Predict Changes in Populations Based on the Food Web" item **28%** of the time receiving a likely scale score of **177**.

7. **Stability and Change** – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale.
- Small changes in one part of a system might cause large changes in another part.
- Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

Explore NAEP items



NOTE: Percentages may not add to 100 due to rounding. Off task applies to responses that do not address the question presented, are illegible, or cannot otherwise be scored.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

*Footnote: All *Crosscutting Concept* information was obtained from: http://www.nextgenscience.org/search-performance-expectations. More examples of crosscutting concepts can be found in the NGSS Appendix G-Crosscutting Concepts.

Montana's Content Standard 3: 3.1 and 3.2

Content Standard 3—Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment.

1. Compare the structure and function of prokaryotic cells (bacteria) and eukaryotic cells (plant, animal, etc.) including the levels of organization of the structure and function, particularly with humans

A. Identify and observe single-celled and multicellular organisms
NAEP: L8.1
NGSS: MS-LS1-1; MS-LS1-2

C. Classify cells as prokaryotic and eukaryotic
NAEP: L8.1
NGSS: MS-LS1-2

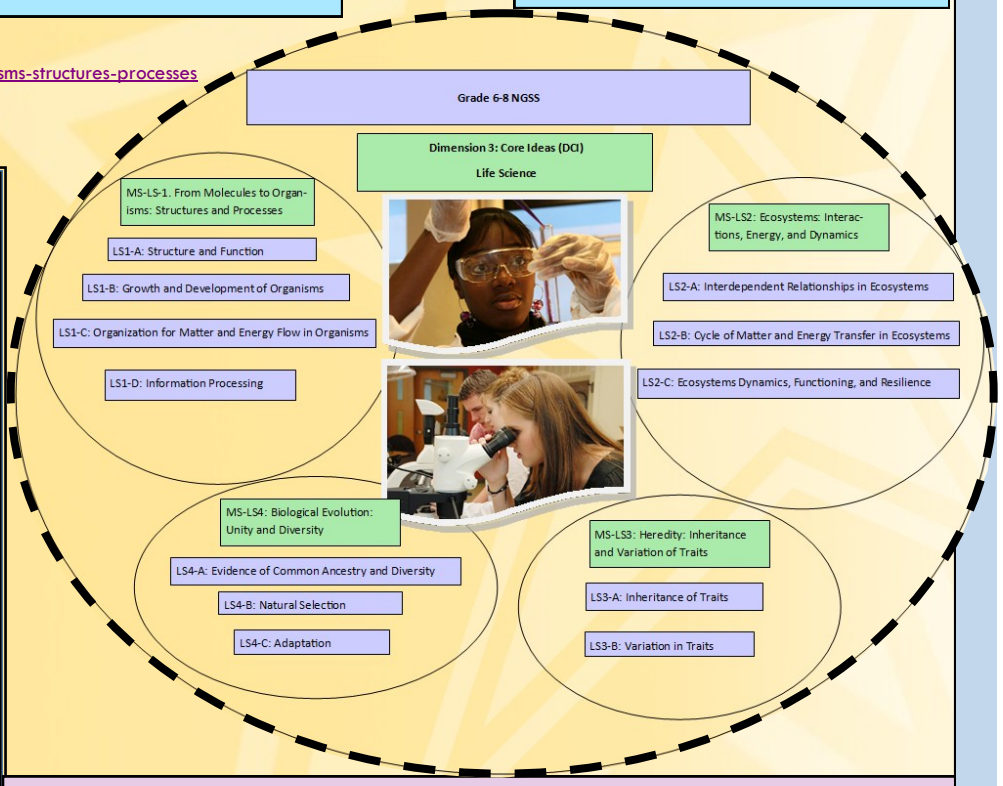
E. Define cell, tissue, organ, system, and organism
NAEP: L8.1
NGSS: MS-LS1-3

B. Define nucleus, prokaryotic and eukaryotic cells
NAEP: L8.1
NGSS: MS-LS1-2

D. Identify and describe the functions of cell organelles in meeting the needs of cells
NAEP: L8.3
NGSS: MS-LS1-2

F. Illustrate the hierarchal relationships of cells, tissues, organs, organ systems, and organisms
NAEP: L8.1
NGSS: MS-LS1-3

http://www.nextgenscience.org/msls1-molecules-organisms-structures-processes



Proficient (170) -Students should be able to demonstrate relationships among closely related science principles. They should be able to identify evidence of chemical changes; explain and predict motions of objects using position time graphs; explain metabolism, growth, and reproduction in cells, organisms, and ecosystems; use observations of the Sun, Earth, and Moon to explain visible motions in the sky; and predict surface and ground water movements in different regions of the world. They should be able to explain and predict observations of phenomena at multiple scales, from microscopic to macroscopic and local to global, and to suggest examples of observations that illustrate a science principle. They should be able to use evidence from investigations in arguments that accept, revise, or reject scientific models. They should be able to use scientific criteria to propose and critique alternative individual and local community responses to design problems. Source: www.nagb.gov (click here)

2. Explain how organisms and systems of organisms obtain and use energy resources to maintain stable conditions (e.g., food webs, photosynthesis, respiration)

A. Describe the process by which organisms (plants and animals) use the energy from sugars to carry out life functions.
NAEP: L8.3; L8.4; L8.6
NGSS: MS-LS1-7

C. Diagram the flow of energy through photosynthesis and its decomposition through respiration.
NAEP: L8.3; L8.4; L8.5; L8.6
NGSS: MS-LS1-6; MS-LS1-7

B. Explain the process by which organisms obtain energy from the sun.
NAEP: L8.3; L8.4; L8.5; L8.6
NGSS: MS-LS1-7

D. Analyze energy movement in biomes (food webs and pyramids)
NAEP: L8.5; L8.6; L8.7
NGSS: MS-LS1-6; MS-LS2-1; MS-LS2-3; MS-LS1-7

E. Classify organisms in food webs based upon characteristics (e.g., physical and behavior)
NAEP: L8.6

http://www.nextgenscience.org/msls1-molecules-organisms-structures-processes

*Footnote: Green boxes indicate OPI standards, Pink boxes indicate benchmarks and Blue boxes indicate Essential Learning Expectations (ELEs).

Montana's Content Standard 3: 3.3 and 3.4

Content Standard 3—Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment.

3. Communicate the differences in the reproductive processes of a variety of plants and animals using the principles of genetic modeling (e.g., punnett squares)

A. Explain the function of a chromosome
NGSS: MS-LS3-1

B. Identify organisms that have different numbers of chromosomes.
NGSS: MS-LS3-1

C. Identify the number of chromosomes in human body cells and human sex cells.

M. Predict genetic crosses using punnett squares

H. Define and identify gene, inheritance, phenotype, and genotype.
NGSS: MS-LS3-1; MS-LS4-5

E. Describe the key events in each phase of mitosis.
NAEP: L8.3; L8.2
NGSS: MS-LS3-2

F. Identify the differences in mitosis and meiosis.
NAEP: L8.9; L8.2
NGSS: MS-LS3-2

G. Differentiate between sexual reproduction and asexual reproduction.
NAEP: L8.9
NGSS: MS-LS3-2

D. Identify the purposes of cell division.
NAEP: L8.2

I. Define and identify dominant and recessive traits.
NGSS: MS-LS4-5

J. Identify examples of inherited characteristics.
NAEP: L8.9; L8.10
NGSS: MS-LS4-5

K. Explain why inherited characteristics of living things depend on genes.
NAEP: L8.10
NGSS: MS-LS3-1

N. Interpret simple genetic crosses using punnett squares

L. Define punnett square and genetic cross

http://www.nextgenscience.org/msls3-heredity-inheritance-variation-traits
http://www.nextgenscience.org/msls4-biological-evolution-unity-diversity

4. Investigate and explain the interdependent nature of populations and communities in the environment and describe how species in these populations adapt by evolving

A. Distinguish between a population and a community.
NAEP: L8.6
NGSS: MS-LS2-1

B. Identify living and non-living factors that effect populations and communities.
NAEP: L8.4; L8.7
NGSS: MS-LS2-4; MS-LS2-3; MS-LS2-1; MS-LS2-2; MSLS2-5

C. Identify the different types of symbiosis and their positive and negative effects.
NAEP: L8.6

F. Define natural selection
NAEP: L8.8; L8.11
NGSS: MS-LS4-4

*NGSS: MS-LS4-6 AND MS-LS2-5 not categorized

D. Explain how populations are impacted by changes in living —and non-living factors in the environment.
NAEP: L8.7; L8.8; L8.11

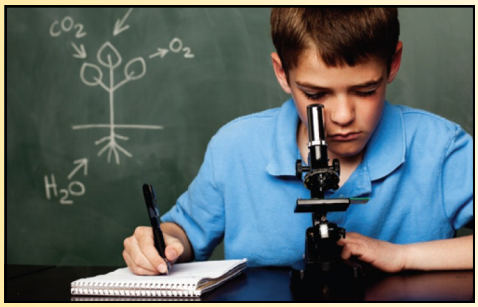
E. Explain and provide examples of adaptations
NAEP L8.6; L8.4
NGSS: MS-LS4-2

J. Explain how the fossil record provides evidence of life forms' appearance, diversification, and extinction.
NAEP: L8.8; L8.11
NGSS: MS-LS4-1; MS-LS4-3

G. Explain the relationship between adaptations and natural selection.
NAEP: L8.6; L8.11
NGSS: MS-LS4-1; MS-LS4-2; MS-LS1-4

H. Identify natural selection as a mechanism for evolution.
NAEP: L8.6; L8.8; L8.11
NGSS: MS-LS1-5; MS-LS1-4; MS-LS4-1; MS-LS4-4

I. Identify lines of evidence that support evolution.
NAEP: L8.8
NGSS: MS-LS4-1; MS-LS4-3



http://www.nextgenscience.org/msls1-molecules-organisms-structures-processes
http://www.nextgenscience.org/msls2-ecosystems-interactions-energy-dynamics
http://www.nextgenscience.org/msls4-biological-evolution-unity-diversity

*Footnote: Green boxes indicate OPI standards, Pink boxes indicate benchmarks and Blue boxes indicate Essential Learning Expectations (ELEs).

Montana's Content Standards 3.5 & 6.2; NAEP Practices

Content Standard 3—Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living

5. Create and use a basic classification scheme to identify plants and animals

A. Explain the relationship between kingdom, phylum, class, order, family, genus, and species.

B. Identify and describe similarities and differences among organisms of different, but closely related taxa (i.e., pine trees, big cats, rodents ungulates).

C. Create and use a basic classification scheme to identify plants and animals.

Content Standard 6—Students understand historical developments in science and technology.

2. Identify major milestones in science that have impacted science, technology, and society

B. Identify and describe the importance of various life scientists and their discoveries such as Hooke & Van Leeuwenhoek (development of microscope), Pasteur (pasteurization and vaccines), Mendel (heredity), Darwin (evolution), Curie (radiation), Linnaeus

Grade 8 NAEP Practices

Identifying Science Principles

1.Describes, measure, or classify observations.

2.State or recognize correct science principles.

3.Demonstrate relationships among closely related science principles.

4.Demonstrate relationships among different representations of principles.

Using Science Principles

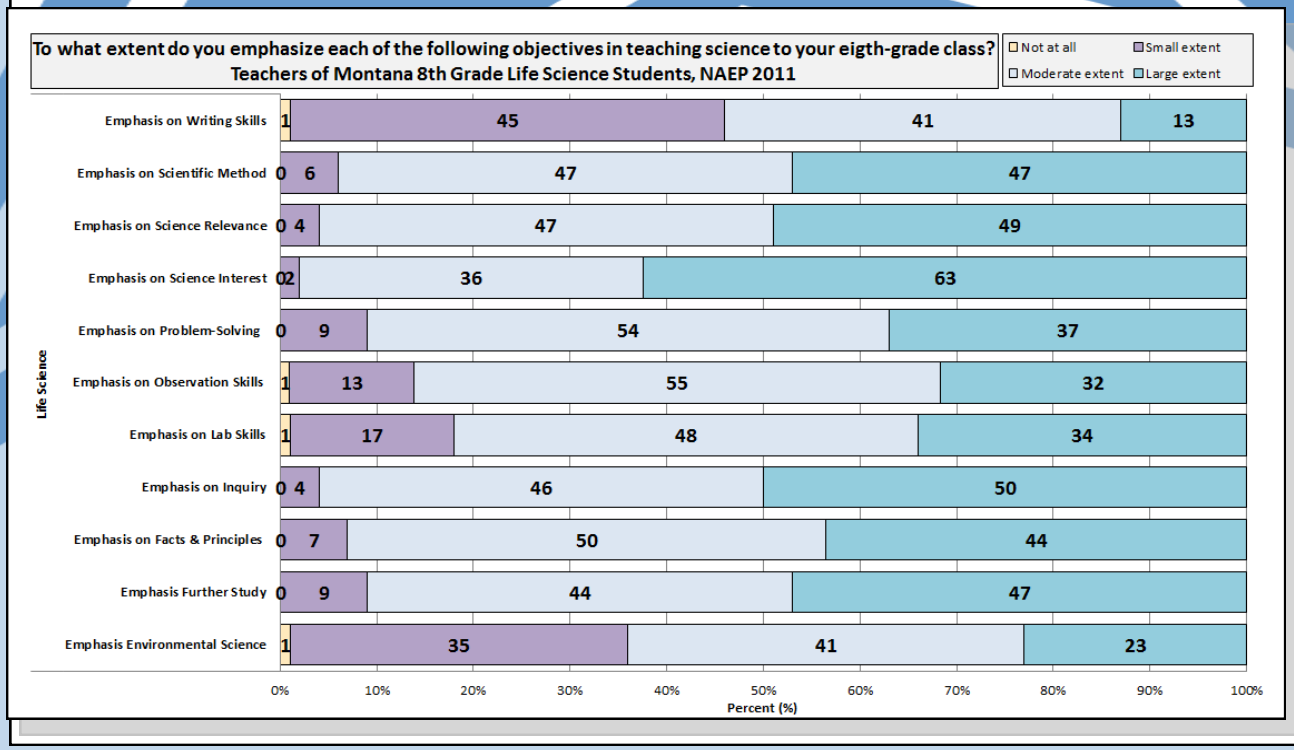
1.Explain observation of phenomena.

2.Predict observations of phenomena.

3.Suggest examples of observations that illustrate a science principle.

4.Propose, analyze, and/or evaluate alternative explanations or predictions.

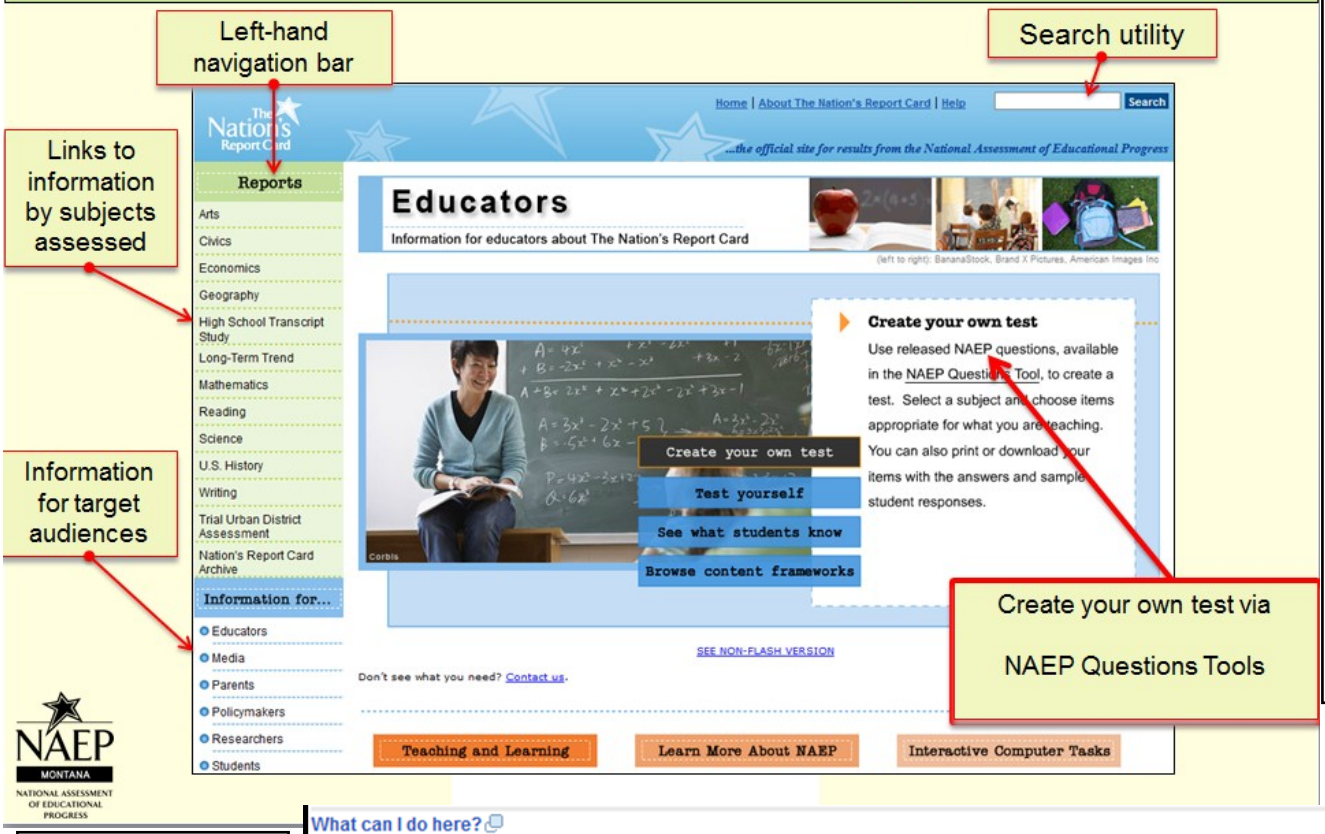
Explore NAEP data in the NDE



NOTE: Percentages may not add to 100 due to rounding. SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2011 Science Assessment.

Exploring NAEP Questions Tool (NQT)

http://nationsreportcard.gov/educators.asp



For more help on how to obtain NAEP items, please visit Montana's NAEP Wiki at:

http://www.opi.mt.gov/groups/montananaep/

OR

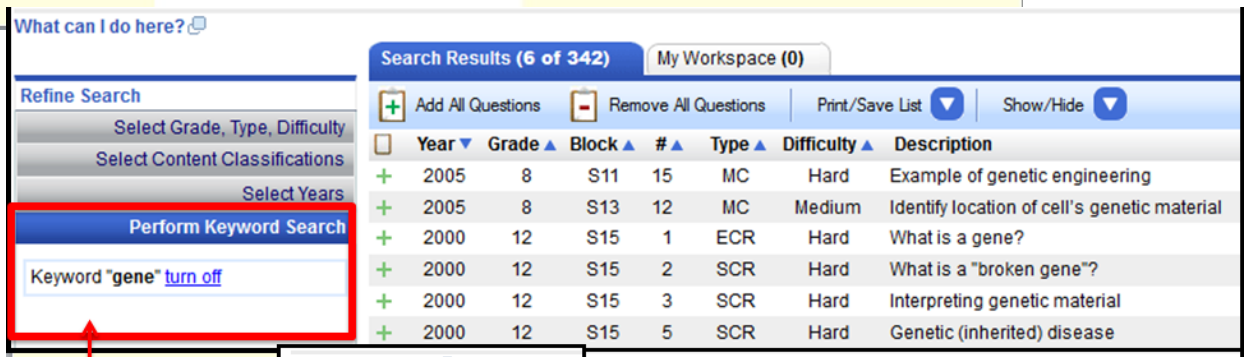
Click here to access the NAEP Questions Tool (NQT) instructional videos.

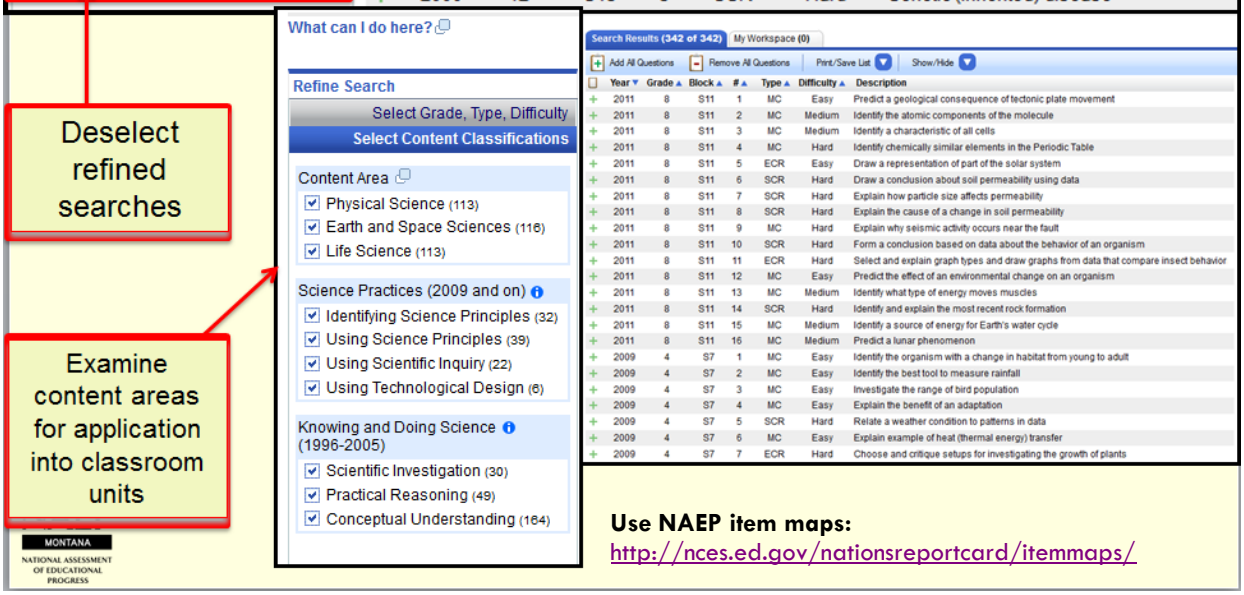
Classroom contexts. Results from the cognitive items provide information about what students *know* and *can do* in a subject area. Information from the background items gives context to NAEP results and allows researchers to track factors associated with academic achievement. These results are sorted into 8 broad categories: Major Reporting Groups, Student Factors, Factors Beyond School, Instructional Content and Practice, Teacher Factors, School Factors, Community Factors, and Government Factors. Here are some resources and/or strategies for reporting NAEP data with a classroom context.

Click here

Click here

Click here





Use NAEP item maps:
http://nces.ed.gov/nationsreportcard/itemmaps/

Draw a conclusion about soil permeability using data

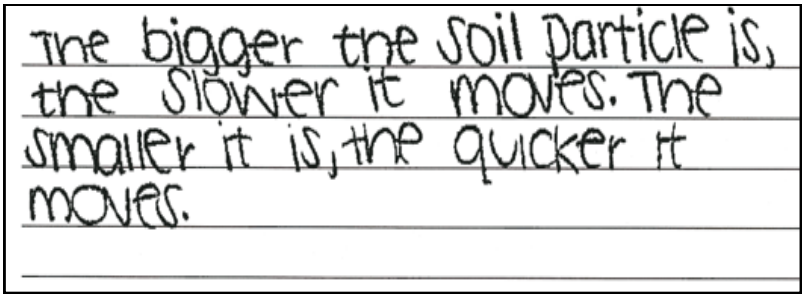
This Question 6 refers to the following information.

Most soils are a mixture of particles of different sizes. Water moves through soil at different rates, depending largely on how much of each size particle makes up the soil. The table below shows the percentage of each size particle in five different soils (A, B, C, D, E) and the rate at which water moves through each of the soils.

RATE OF WATER MOVING THROUGH DIFFERENT SOILS

Soil	Percentage Largest Particles (%)	Percentage Medium-Sized Particles (%)	Percentage Smallest Particles (%)	Rate of Water Draining Through Soil (cm/hr)
A	100	0	0	21
B	85	10	5	6.1
C	40	40	20	1.3
D	20	65	15	0.69
E	0	0	100	0.05

1. Describe the relationship between the size of the soil particles and the rate at which water moves through the soil. Use the data in the table to support your answer.

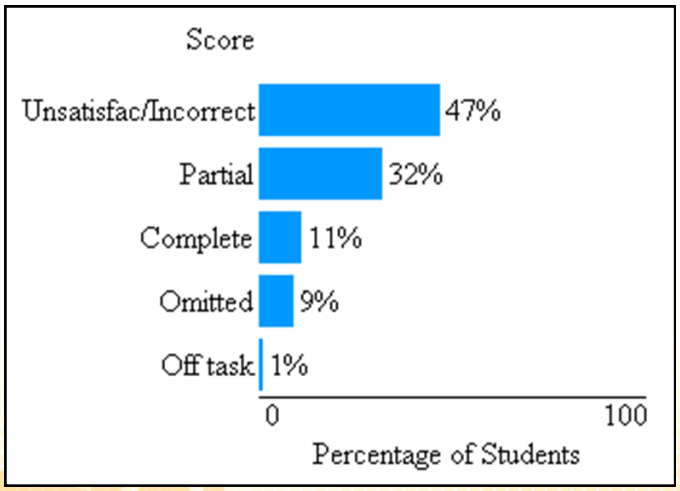


Scorer Comments: The first response provides an incorrect statement about the relationship between soil particle size and the rate of water movement through the soil. The second response fails to establish the relationship between soil particle size and rate of water movement.

Score & Description
Complete Student response correctly describes the relationship between the size of soil particles and the rate at which water moves through soil, referring to data in the table for support. Response demonstrates understanding that water moves faster through soil of larger size particles.
Partial Student response correctly describes the relationship between particle size and rate of water movement, but does not refer to the data in the table for support. OR Student response provides a correct statement about the data in the table, which addresses the relationship between the size of soil particles and the rate at which water moves through the soil, but does not establish the relationship.
Unsatisfactory/Incorrect Student response is inadequate or incorrect.

NAEP national performance results in Science at grade 8: 2011

Draw a conclusion about soil permeability using data



NOTE: These results are for public and nonpublic school students. Percentages may not add to 100 due to rounding. Off task applies to responses that do not address the question presented, are illegible, or cannot otherwise be scored. SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2011 Science Assessment.

http://nces.ed.gov/nationsreportcard/tel/

TECHNOLOGY

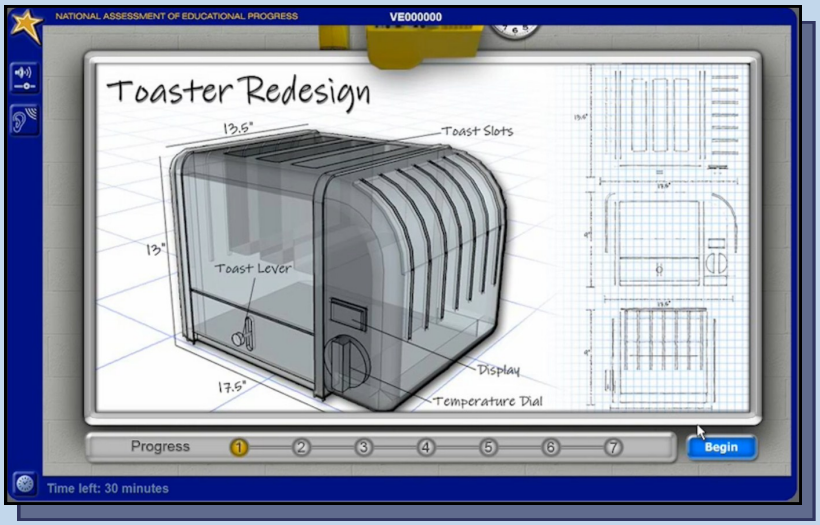
TEL IS CROSS-CURRICULAR.

Total of **18,000** students will participate in NAEP's 2014 TEL assessment.

⇒ TEL is a computer based assessment which will measure students' capacity to use, understand, and evaluate technology, as well as to understand technological principles and strategies.

⇒ Students will spend about 120 minutes completing the assessment.

⇒ For more information on the cognitive demands and expectations for students, please visit the NAEP TEL framework at: http://www.nagb.gov/publications/frameworks/technology/2014-technology-framework/toc.html



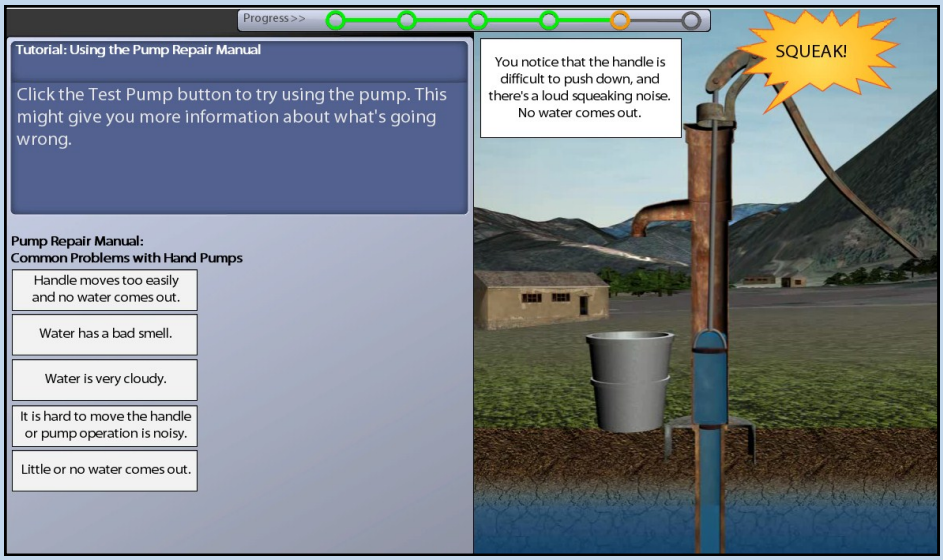
What is TEL?

NAEP
NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

What does a TEL item look like?

Can I try a TEL item?

Interactive Framework



NAEP Questions Tool

The questions in the NAEP Questions Tool are presented for the use of teachers, parents, students, and others as: (1) examples of what NAEP asks students at grades 4, 8, and 12 for main NAEP, and at ages 9, 13, and 17 for long-term trend; (2) exemplars of questions that probe students' knowledge of a specific content area; and (3) a way to compare an individual's performance on a specific question to that of the students across the nation and in the state. For more information, visit http://nces.ed.gov/nationsreportcard/itmrlsx/landing.aspx

NAEP Item Maps

Item maps help to illustrate what students know and can do in NAEP subject areas by positioning descriptions of individual assessment items along the NAEP scale at each grade level. An item is placed at the point on the scale where students are more likely to give successful responses to it. The descriptions used in NAEP item maps focus on the knowledge and skills needed to respond successfully to the assessment item. For more information, visit http://nces.ed.gov/nationsreportcard/itemmaps/index.asp

Test yourself

Try sample questions in a variety of subjects for yourself. At the end of the quiz, see how students across the nation performed. For more information, visit http://nationsreportcard.gov/testyourself.asp

Interactive Computer Tasks (ICTs)

These tasks presented students with computer-based environments where students were asked to solve authentic scientific problems. There are nine released ICTs available to the public. For more information, visit http://nationsreportcard.gov/science_2009/ict_tasks.asp

Hands-On Tasks (HOTs)

These tasks gave students real-world contexts where students were asked to demonstrate how well they are able to plan and conduct scientific investigations, reason through complex problems, and apply their scientific knowledge. There are three released HOTs available to the public. For more information, visit http://www.youtube.com/watch?v=6RNpps7zdlE&list=PLkEhwZQdyNEEF3ayHdye-kweX7DyF3Awb&index=5

Introducing NAEP to Teachers

Educators explaining the importance of NAEP, the relevance of NAEP and how it applies to teachers. For more information, visit http://www.youtube.com/watch?v=zR1_pUdSlFg&list=PLkEhwZQdyNEEF3ayHdye-kweX7DyF3Awb&index=1
Create your own NAEP test and see what students know and can do. For more information, visit http://nationsreportcard.gov/educators.asp

Images property of NAEP; NAEP frameworks, data and assessment results were taken from the NAGB, Main NAEP NDE, NQT and The Nation's Report Card.

NAEP items can be used as a helpful educational resource in the classroom. Teachers can use the NAEP Questions Tool to see how students' performance compares on specific items. You can also request any information or specific research data from your NAEP State Coordinator, **Ashley McGrath at amcgrath@mt.gov.**

NAEP Webpage: http://opi.mt.gov/Reports&Data/NAEP.html

NAEP Wiki: http://opi.mt.gov/groups/montananaep/

NAEP
MONTANA
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